

independent claim 1 and 33 do not add up to one hundred percent (100%) and because the previously presented recitation of percentages eludes the ability of one skilled in the art to perceive the various friction materials claimed.

The Applicants respectfully submit that the claims, as previously presented, particularly point out and distinctly claim the invention. Nevertheless, independent claims 1 and 33 are amended to recite that the non-woven fibers and the resin in the friction material are found in specific proportions with an additional substance. The Office has suggested that this recitation is definite. The Applicants concur that this recitation is also definite. Accordingly, the Applicants respectfully request withdrawal of the rejection under 35 U.S.C. 112(b).

Rejections Under 35 U.S.C. § 103(a) over Bortz

Claims 1-7, 9-11, 25, 28, and 33-39 were rejected under 35 U.S.C. § 102(b) as being unpatentable over Bortz (US 5,646,076). The Office asserts that Bortz teaches examples such as the friction material claimed by the Applicants. The Office asserts that Bortz shows many different percentage ranges in terms of the fiber and resin contents and hence, modifying the content percentages would depend on the end use of the friction material to be constructed. The Office further asserts that modifying the percentage to an optimum working range would only involve routine skill.

The Office also alleges that example 15 of Bortz discloses the variables recited by the claims of the Applicants' invention. Example 15 is alleged to disclose a composite which can have a maximum of 60% fiber and in which the rest of the composite would be either a mixture of resin and particulates or just resin. The Office alleges such an exemplary composite would meet the limitations of Applicants' claims and maintains that the claimed invention is obvious.

The Applicants respectfully traverse this rejection and request full consideration of the following remarks, which distinguish the claimed invention from Bortz. Initially, Applicants submit that Bortz does not disclose or suggest the Applicants' claimed invention. Claim 1 recites, in part, a friction material comprising approximately 20% to 40% by weight a mat of non-woven fibres and approximately 40% to 60% by weight a thermosetting resin which impregnates said fibres. Bortz fails to disclose, or even suggest, a friction material with these claimed characteristics.

As the Office asserts, Bortz does disclose various examples of composite materials that utilize different percentage ranges in terms of fiber content and resin content, the material of the fiber content and resin content varying widely. Specifically, Bortz discloses seventeen (I-XVII) examples of a composite material.

In example I, the composite includes a carded web and is 30% by weight dry phenolic resin solids. Examples II-IV disclose a composite similar to example I with the exceptions that the carded web is or includes fibers of various alternative materials in differing proportions, and the composite is cut and/or resin impregnated at differing points in the composite fabrication process.

Example V discloses a composite including a carded web and an imprecise percentage of resin solution described as "diluted so as to effect a minimally adequate amount of dried resin in the product to accomplish necessary densification under heat and compression while presenting a maximum amount of fiber to the friction surface." Examples VI-X disclose a composite similar to example V with the exceptions that the carded web is or includes fibers of various alternative materials in differing proportions, and the composite is cut and/or resin impregnated at differing points in the composite fabrication process.

Example XI discloses a composite including a carded web and 50% by weight dry resin solids of a polysiliconeimide. Examples XII-XIV disclose a composite including various alternative materials for the web with an unstated percentages of carded web and resin in the composite.

Example XV discloses a composite including a carded web and an imprecisely recited "appropriate amount" of phenolic resin. See Bortz col. 16, ln. 38. In this exemplary composite, the carded web is a blend of 30% Nomex and 70% by weight Kevlar fibers. Lubricating particles of graphite flakes or molybdenum disulfide are dispersed across the web to effect 40% by dry weight of the dry web. Cut annuli of the composite are compressed to effect a desirable density ranging from porous and resilient to hard and dense.

Example XVI discloses a composite including a carded web and 28% by weight of dry resin solids from a phenolic resin. Example XVII fails to state the percentage of each material in the resultant composite.

The Applicant respectfully submits that none of these specific teachings of Bortz

discloses the claimed invention. As the Office acknowledged in the previous Office Action, while teaching various examples of friction materials that may utilize many different fiber content and resin content percentage ranges, Bortz fails to teach the friction material claimed by the present invention. Specifically, the Applicants note: examples I-IV fail to disclose the range claimed by the present claims; examples V-X disclose imprecise percent ranges; examples X1-XIV fail to disclose percentages of carded web and resin in the composite; example XV fails to disclose the percentage of the carded web that comprises the composite material and states the percentage of resin as an "appropriate amount." Example XVI fails to disclose the resin percentage claimed by present claims; and example XVII fails to disclose percentages of carded web and resin in the composite.

In contrast, the Applicants' claimed invention provides a friction material comprised of specific content percentage ranges for the mat and the thermosetting resin, with a claimed relationship between the percentage of the mat of non-woven fibers and the percentage of thermosetting resin in the resultant friction material. This resultant friction material has increased strength and durability over prior art friction materials.

Second, the various examples of friction materials taught by Bortz fail to disclose or suggest modification of the content percent of the mat of non-woven fibers versus the content percent of the thermosetting resin to provide the resultant friction material claimed by the Applicants. While teaching various embodiments of friction materials different than the friction material claimed by the Applicants, Bortz merely states that differences in coefficients of friction can be effected by a change in the fiber, polymer matrix, or construction of a composite material. Bortz column 1, line 55-60. However, Bortz fails to disclose or suggest a composite comprising the percentage range by weight of fiber mat and thermosetting resin claimed by the Applicants.

Specifically, with respect to example XV of Bortz, which the Office asserts discloses the Applicants' claimed invention, the Applicants respectfully submit that the Office overstates the teaching of the disclosure. Example XV teaches cut annuli of the composite are compressed to effect a desirable density ranging from porous and resilient to hard and dense. The composite includes a carded web and an imprecisely recited "appropriate amount" of phenolic resin. The carded web is a blend of 30% Nomex and 70% by weight Kevlar fibers. Lubricating particles of graphite flakes or molybdenum disulfide are dispersed across the web to effect 40% by dry

weight of the dry web. Example XV does not disclose or suggest a friction material comprising approximately 20% to 40% by weight a mat of non-woven fibers and approximately 40% to 60% by weight a thermosetting resin. Further, example XV of Bortz does not teach variation of the content percent of the mat of non-woven fibers and the thermosetting resin to effect a composite having increased strength and durability and a superior working time to that of the prior art.

Bortz fails to teach variation of the content percent of the mat of non-woven fibers and the thermosetting resin, as disclosed by the Applicants, which variation results in the claimed friction material having improved characteristics. Bortz does not teach or suggest the content percentages of non-woven mat and thermosetting resin are result effective variables that should be worked to an optimum range to provide the friction material of the Applicants' claimed invention. Simply, Bortz fails to disclose or suggest variation of the parameters taught by the Applicant. Bortz merely discloses various material used in friction material compositions. In other words, Bortz creates a different end product adapted to a particularly desired end use by varying parameter different than those taught by the Applicant. In contrast, the friction material of the Applicants' claims provides specific content percentage ranges that can be varied that result in a friction material having increased strength and durability over the prior art

Third, differences in properties cannot be disregarded on the ground they are differences in degree rather than in kind. Claim 1 recites a friction material comprising approximately 20% to 40% by weight a mat of non-woven fibers and approximately 40% to 60% by weight a thermosetting resin which impregnates the fibers. The claimed friction material recites with specificity the proportion of non-woven fibers and thermosetting resin. In contrast, Bortz fails to provide or suggest such teaching as Bortz leaves unstated the composition of the exemplary friction material beyond stating a singular percentage for the mat or the resin of the exemplary friction material. Bortz fails to teach or suggest the claimed relation between the total weight of the non-woven fiber mat and the total weight of the impregnating thermosetting resin in terms of the total weight of the friction material. The claimed invention, on the other hand, provides teaching of both the percentage of a non-woven mat and the percentage of a thermosetting resin of which results in a friction material that displays a remarkable stability while having a coefficient of friction very close to that of prior art paper-type friction materials.

Accordingly, the Applicants submit that the teaching of Bortz does not render the claim 1

obvious. For the above stated reasons, amended Claim 1 is believed to distinguish patentably from Bortz. Accordingly, reconsideration and withdrawal of the rejection of claim 1 under Section 102 is respectfully requested.

As Claims 2-7, 9-11, 25, and 28 directly and indirectly depend from Claim 1, each of these claims is believed to be allowable over the prior art based on that dependency and the reasons stated above. In addition, each of these claims is believed patentable based on the additional novel matter contained therein. Accordingly, reconsideration and withdrawal of the rejection of Claims 2-7, 9-11, 25, and 28 is respectfully requested.

Claims 6, 7, and 25 recite the inclusion of fibers in the form of pulps in the claimed friction material. Bortz fails to disclose or suggest inclusion of this type of material in friction material it teaches. For this reason, the Applicants respectfully submit that claims 6, 7, and 25 are patentable over the Bortz reference.

Conclusion

Based on the foregoing remarks, it is respectfully submitted that all the claims as currently pending are patentable and in condition for allowance. Reconsideration of the application and withdrawal of the rejections are respectfully requested.

In the event that a telephone conference would facilitate examination in any way, the Examiner is invited to contact the undersigned representative at the number provided.

Respectfully submitted,



David M. La Bruno Reg. No. 46,266

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MORGAN & FINNEGAN, L.L.P.
345 Park Avenue
New York, New York 10154-0053
(212) 758-4800 Telephone
(212) 751-6849 Facsimile



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CLAIMS MARKED TO SHOW CHANGES MADE

1. (Four Times Amended) A friction material designed for fitting to a device employing friction in a liquid medium, the friction material comprising

approximately 20% to 40% by weight a mat of non-woven fibres and

approximately 40% to 60% by weight a thermosetting resin which impregnates said fibres, wherein said fibres have a length of at least 12 mm, wherein the non-woven fibres and the resin are found in specific proportions with an additional substance.

2. A friction material according to Claim 1, wherein the average length of the fibres is at most 120 mm.

3. A friction material according to Claim 2, wherein the fibres are chosen from the group consisting of glass, wool, cotton, ceramic, polyacrylonitrile, preoxidized polyacrylonitrile and aramid.

4. A friction material according to Claim 3 further including
fillers in powder form incorporated into the mat.

5. A friction material according to Claim 4, wherein said fillers in powder form are selected from the group consisting of copper, rockwool, carbon, zirconium silicate, iron sulphide, alumina, rubber and diatoms.

6. A friction material according to Claim 4 further including
fillers in the form of pulps incorporated into the mat.

7. A friction material according to Claim 6, wherein said fillers in pulp form are selected from the group consisting of the pulps of glass, aramid, acrylic and phenolic fibres.

9. A friction material according to Claim 1, wherein the thermosetting resin is resol-based.

10. A friction material according to Claim 1, wherein latex is added to the thermosetting resin.

11. A friction material according to Claim 1 further including

fillers in powder form incorporated into the thermosetting resin, wherein said fillers in powder form are selected from the group consisting of copper, rockwool, carbon, zirconium silicate, iron sulphide, alumina, rubber and diatoms.

25. A friction material according to Claim 5 further including

fillers in the form of pulps incorporated into the mat.

28. A friction material according to Claim 1, wherein the thermosetting resin includes a polar solvent, the polar solvent being an aqueous polar solvent.

33. (Amended) A friction material for a device employing friction in a liquid medium, the friction material comprising a mat of non-woven fibres impregnated with a thermosetting resin, wherein the friction material comprises by weight

approximately 20% to 40% fibres selected from the group consisting of glass, wool, cotton, ceramic, polyacrylonitrile, preoxidized polyacrylonitrile and aramid; and

approximately 40% to 60% thermosetting resin selected from the group consisting of water-based resins, resol-based resins, phenolic plastic resins, aminoaldehyde resins, epoxy resins and polyimide resins, wherein the fibres and the thermosetting resin are found in specific proportions with an additional substance.

34. The friction material according to Claim 33 wherein the fibres have an average length of between approximately 12 mm and 120 mm.

35. The friction material according to Claim 33 that is by weight approximately 20% glass fibres, 10% ceramic fibres, 10% polyacrylonitrile fibres, and 60% water-based resin.

36. The friction material according to Claim 33 that is by weight approximately 30% cotton

fibres, 10% ceramic fibres, and 60% water-based resin.

37. The friction material according to Claim 33 further including

fillers selected from the group consisting of copper, rockwool, carbon, zirconium silicate, iron sulphide, alumina, rubber, diatoms, glass, aramid, acrylic and phenolic fibres.

38. The friction material according to Claim 37 that is by weight approximately 20% glass fibres, 10% ceramic fibres, 10% polyacrylonitrile fibres, 10% carbon, 10% coke, and 40% resol-based resin.

39. (Amended) The friction material according to Claim 37 that is by weight approximately 20% glass fibres, 10% ceramic fibres, 10% polyacrylonitrile fibres, 10% copper, 10% rockwool, and 40% resol-based resin.